Esri Response to NASA Request for Information - Preparation for the Development of a Community-Based Roadmap for NASA's Planetary Data Services

Response to Topic 1

1. What tools, resources, workflows, tutorials, and interfaces will future users expect or require?

• Name of submitter and contact information (institutional affiliation, E-mail address);

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NASA has been a valued Esri customer for over 20 years. Esri's full ArcGIS product stack is available to the majority of the scientific community at no additional cost, including all NASA and USGS missions. The majority of academic institutions worldwide maintain educational site licenses which also give their staff and students unlimited access to the ArcGIS Platform. Finally, qualified nonprofit organizations and individuals of the public can receive the full analytics product stack for as little as $150. In addition to the powerful analytics and serving components above, ArcGIS includes a free viewing applications (such as StoryMaps and ArcGIS Earth) for the public to interact with and query the data. Further, ArcGIS has a full suite of free and open Software Development Toolkits (SDKs) and Application Programmer Interfaces (APIs) that scientists can use to develop custom clients.

Since 1969, Esri has helped organizations map and model our world. Our GIS technology allows users to effectively manage and analyze geographic information so they can make better decisions. We offer flexible, configurable, and easy-to-use geospatial solutions that let anyone access informative maps and location apps anywhere and on any platform or device. These solutions are supported by our experienced staff and extensive network of business partners and international distributors.

Esri applications provide the backbone for the world's mapping and location analysis. Esri software is used in more than 350,000 organizations worldwide including each of the 200 largest cities in the United States, more than two-thirds of Fortune 500 companies, more than 24,000 state and local governments worldwide, and many others in dozens of industries. Private ownership, a zero-debt policy, and a firm commitment to fulfilling the needs of our customers all help Esri maintain its position as the world leader in GIS software.

As a socially conscious business, we are proud that our technology is used by many organizations who apply location-based insights to solve problems and make our world a better place to live. We also actively support organizations involved in education, conservation, sustainable development, and humanitarian affairs.

• A clear and concise statement of the topic addressed;

Collection of multidimensional data at NASA is on the rise due to the continued advancements in sensor technology. Over the next 10 years, the size and frequency of multidimensional data collected by NASA missions will continue to grow rapidly in parallel with the aforementioned technological advancements. Data collections (such as atmospheric composition, elevation features, and changes over time of certain phenomenon as planets are monitored at different stages of their orbit) will be most useful if made available to scientists in 3D formats for visualization and manipulation. To support the above, the PDS should adopt a standard format and apps for both multidimensional data archiving and interaction that embrace and support native 3D datasets.

• An articulate and compelling rationale for why the chosen topic would be significant to a wide range of planetary scientists;

Interaction with multidimensional data in 3D, through the ability to view related and contextual data co-registered in a known frame, can foster insights that might not happen in a traditional 2D data. Making data available natively in standardized 3D formats and using standardized (but open) APIs and SDKs will ensure maximum reusability and utility to the planetary science community of the data.

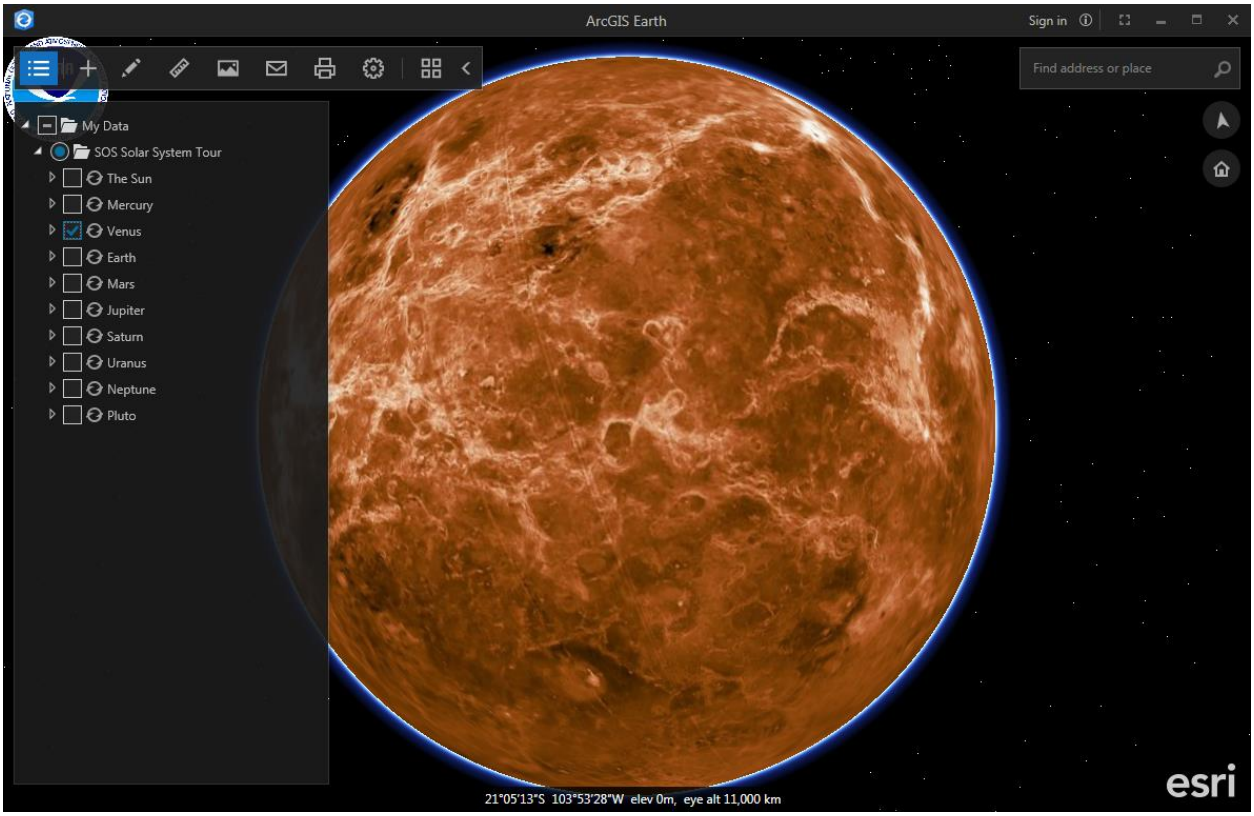
The 2D equivalent of multidimensional data analysis is well established in modern geographic information systems (GIS). Today 3D GIS is maturing rapidly, opening a new category of applications, science and otherwise. By standardizing formats for 3D data archival and interaction, the PDS can make it easier for software manufacturers to support planetary data in commonly used tools, including GIS. Finally, standardized data formats will help scientists overlay data from different missions and sources in a consistent and effective way.

• Suggested improvements or changes relevant to the topic;

Esri believes the PDS should designate a unified format specification that data providers can use as they produce data. The PDS should work with scientists to convene and agree on data formats as new formats emerge, or specify adherence to standard-making bodies (such as the Open Geospatial Consortium, or OGC) for data product acceptance. This will make it easier for users to expertly leverage multidimensional data moving forward.

Agreeing to standard data formats will also help the PDS leverage the 2D and 3D service capabilities from the server software included in the NASA-Esri ELA. This will allow the PDS to provide content through easy-to-configure web template tools that the public and other scientists can consume with little or no development effort. Alternatively, both scientists and the public could use open Esri APIs and SDKs to build and integrate the PDS services into their own custom applications and interfaces.

Mars KML as viewed in ArcGIS Earth



Venus KML as viewed in ArcGIS Earth.

• A discussion of the impact of not making the suggested improvements or changes; and,

Planetary scientists will experience difficulty in the manipulation and integration of disparate datasets for analyses due to their varying formats. The PDS will miss opportunities to display data in motivating and captivating ways.

• A discussion of the potential impacts of the suggested improvements or changes.

Ease of integration and ability to display data for browsing and analysis in a compelling manner.